

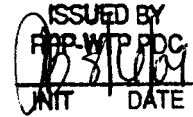
## PLANT ITEM MATERIAL SELECTION DATA SHEET



RLD-VSL-00002 (HLW)

## Offgas Drains Collection Vessel

- Design Temperature (°F)(max/min): 167/40
- Design Pressure (psig) (internal/external): 15/FV
- Location: incell



**Contents of this document are Dangerous Waste Permit affecting**

**Operating conditions are as stated on sheets 5 and 6**

The solution is from vapor phase carry-over from HOP-HEME-00001A/B and HOP-HEME-00002A/B.

Not maintainable during the 40 y design life.

**Operating Modes Considered:**

- The vessel is pH  $\approx$  2.4 at the normal operating temperature.

**Materials Considered:**

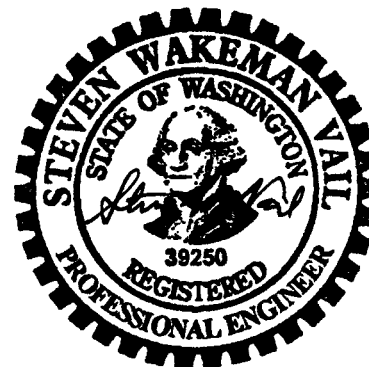
Material (UNS No.)	Relative Cost	Acceptable Material	Unacceptable Material
Carbon Steel	0.23		X
304L (S30403)	1.00		X
316L (S31603)	1.18	X	
6% Mo (N08367/N08926)	7.64	X	
Alloy 22 (N06022)	11.4	X	
Ti-2 (R50400)	10.1		X

**Recommended Material: 316 (max 0.030% C; dual certified)**

**Recommended Corrosion Allowance: 0.04 inch (includes 0.00 inch erosion allowance)**

**Process & Operations Limitations:**

- Develop rinsing/flushing procedure for acid and water.
- Develop lay-up strategy.



**EXPIRES: 12/07/05**

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This bound document contains a total of 6 sheets.

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## PLANT ITEM MATERIAL SELECTION DATA SHEET

### Corrosion Considerations:

This vessel receives little or no transfer of effluent during normal operation. It can receive condensate from the low points in the main offgas ducts downstream of the HOP HEMEs (consider composition consistent with that of the HEMEs), decontamination effluent from HLW C5 drains, and plant wash for level makeup.

#### **a General Corrosion**

Hamner (1981) lists corrosion rates for 304 (and 304L) and 316 (and 316L) of less than about 1 mpy in dilute nitric acid solutions. Based on Uhlig (1948), little uniform corrosion is expected at these conditions. The stated solutions are compatible with the 300 series stainless steel.

#### *Conclusion:*

The 300 series alloys are expected to be acceptable.

#### **b Pitting Corrosion**

No significant concentrations of pitting agents are shown. Due to the possibility of the solution concentrating in the vessel, 316L is recommended.

#### *Conclusion:*

Pitting is not expected to be a concern. 316L is minimum recommended.

#### **c End Grain Corrosion**

End grain corrosion only occurs in highly oxidizing acid conditions.

#### *Conclusion:*

Not applicable.

#### **d Stress Corrosion Cracking**

The exact amount of chloride required to cause stress corrosion cracking is unknown. In part this is because the amount varies with temperature, metal sensitization, and the environment but also because chloride tends to concentrate under heat transfer conditions, by evaporation, and electrochemically during a corrosion process. Hence, even as little as 10 ppm can lead to cracking under some conditions. As seen in Sedriks (1996) and Davis (1987), stress corrosion cracking does not usually occur below about 140°F.

With wash lines available and expected temperature shown at 125°F, there should be minimal chance of cracking.

#### *Conclusion:*

Based on the normal operating environment, 316L is recommended.

#### **e Crevice Corrosion**

With the stated operating conditions, 316L is the minimum acceptable. Also see Pitting.

#### *Conclusion:*

See Pitting.

#### **f Corrosion at Welds**

Corrosion at welds is not considered a problem in the proposed environment.

#### *Conclusion:*

Weld corrosion is not considered a problem for this system.

#### **g Microbiologically Induced Corrosion (MIC)**

The proposed operating conditions are conducive to microbial growth though in this part of the system microbial contaminants are not expected.

#### *Conclusion:*

MIC is not considered a problem.

**PLANT ITEM MATERIAL SELECTION DATA SHEET****h Fatigue/Corrosion Fatigue**

Corrosion fatigue is a not expected to be a concern.

*Conclusions*

Not expected to be a concern.

**i Vapor Phase Corrosion**

Not expected in this system.

*Conclusion:*

Not a concern.

**j Erosion**

Velocities are expected to be low.

*Conclusion:*

Not a concern.

**k Galling of Moving Surfaces**

Not applicable.

*Conclusion:*

Not applicable.

**l Fretting/Wear**

No contacting surfaces expected.

*Conclusion:*

Not applicable.

**m Galvanic Corrosion**

No dissimilar metals are present.

*Conclusion:*

Not expected to be a concern.

**n Cavitation**

None expected.

*Conclusion:*

Not believed to be of concern.

**o Creep**

The temperatures are too low to be a concern.

*Conclusion:*

Not applicable.

**p Inadvertent Nitric Acid Addition**

Vessel operates at low pH under normal conditions.

*Conclusion:*

Not applicable.

**PLANT ITEM MATERIAL SELECTION DATA SHEET****References:**

1. Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073
2. Hamner, NE, 1981, *Corrosion Data Survey*, Metals Section, 5th Ed, NACE International, Houston, TX 77218
3. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158
4. Uhlig, HH, 1948, *Corrosion Handbook*, John Wiley & Sons, Inc., New York, NY 10158

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**Bibliography:**

1. Agarwal, DC, *Nickel and Nickel alloys*, In: Revie, WW, 2000. *Uhlig's Corrosion Handbook*, 2nd Edition, Wiley-Interscience, New York, NY 10158
2. Davis, JR (Ed), 1994, *Stainless Steels*, In ASM Metals Handbook, ASM International, Metals Park, OH 44073
3. Van Delinder, LS (Ed), 1984, *Corrosion Basics*, NACE International, Houston, TX 77084

## PLANT ITEM MATERIAL SELECTION DATA SHEET

## OPERATING CONDITIONS

## PROCESS CORROSION DATA SHEET

Component(s) (Name/ID #) Offgas drains collection vessel (RLD-VSL-00002)Facility HLWIn Black Cell? Yes

Chemicals	Unit <sup>1</sup>	Contract Maximum		Non-Routine		Notes
		Leach	No leach	Leach	No Leach	
Aluminum	g/l	3.33E-04	3.17E-04			
Chloride	g/l	1.01E-02	1.72E-02			
Fluoride	g/l	5.71E-03	1.21E-02			
Iron	g/l	2.08E-03	7.67E-04			
Nitrate	g/l	1.13E+00	7.67E-01			
Nitrite	g/l					
Phosphate	g/l					
Sulfate	g/l					
Mercury	g/l	6.77E-01	5.78E-01			
Carbonate	g/l					
Undissolved solids	wt %	0.07%	0.06%			
Other (NaMnO <sub>4</sub> , Pb,...)	g/l					
Other	g/l					
pH	N/A					Note 2
Temperature	°F					Note 3

## List of Organic Species:

## Notes:

1. Concentrations less than  $1 \times 10^{-4}$  g/l do not need to be reported; list values to two significant digits max.
2. pH  $\leq 2.5$  to 6.5, assumes condensate is worst case
3. T<sub>min</sub> 59 °F, T<sub>norm</sub> 125 °F, T<sub>max</sub> 141 °F

## Assumptions

**PLANT ITEM MATERIAL SELECTION DATA SHEET****5.6.4 Offgas Drains Collection Vessel (RLD-VSL-00002)****Routine Operations**

The offgas drains collection vessel (RLD-VSL-00002) is in a black cell and receives little or no transfer of effluent during normal operation. Vessel RLD-VSL-00002 receives the following: condensate from the low points in the main offgas ducts downstream of the HEMEs (HOP-HEME-00001A/B and HOP-HEME-00002A/B); condensate from the pulse ventilation system header; and plant wash for level makeup to maintain hydraulic seal between the pulse jet ventilation system (PJV), the primary offgas system (HOP) and the C5 cell. The vessel contents are transferred to the plant wash and drains vessel RLD-VSL-00008. The drain lines must be dipped below the liquid level in the vessel to maintain a static water column in the drain line that will balance the pressure differential between the drain location and the vessel vent system. To ensure that the drain lines are below the liquid level, makeup water from the plant wash system will be added to the vessel to compensate for evaporation when condensation does not occur in the offgas system.

**Non-Routine Operations that Could Affect Corrosion/Erosion**

Receives highly acidic effluent from the HEME.